

CLAIMS

What is claimed is:

1. In combination with a metalworking fluid, the improvement comprising the addition thereto of at least one antioxidant and at least one biocide in amounts sufficient to reduce oxidative and biological degradation.
2. The combination of claim 1 wherein the antioxidant is selected from the group consisting of alkylated diphenyl amines and N-alkylated phenylenediamines.
3. The combination of claim 2 wherein the antioxidant is selected from the group consisting of diphenylamine, dialkylated diphenylamine, trialkylated diphenylamine, or mixtures thereof, 3-hydroxydiphenylamine, 4-hydroxydiphenylamine, N-phenyl-1,2-phenylenediamine, N-phenyl-1,4-phenylenediamine, mono- and/or di-butyl-diphenylamine, mono- and/or di-octyl-diphenylamine, mono- and/or di-nonyl-diphenylamine, phenyl- α -naphthylamine, phenyl- β -naphthylamine, di-heptyl-diphenylamine, mono- and/or di-(α -methylstyryl)-diphenylamine, mono- and/or di-styryl-diphenylamine, N,N'-diisopropyl-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1-methylheptyl)-p-phenylenediamine, N,N'-diphenyl-p-phenylenediamine, N,N'-di-(naphthyl-2)-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine, N-(1-methylpentyl)-N'-phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, 4-(p-toluenesulfonamido)diphenylamine, 4-isopropoxydiphenylamine, tert-octylated N-phenyl-1-naphthylamino, and mixtures of mono- and dialkylated t-butyl-t-

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15 octyldiphenylamines.

1 4. The combination of claim 1 wherein the antioxidant is selected from the group
2 consisting of butylated (45%) octylated (19%) diphenylamine, octylated phenyl- α -
3 naphthylamine, mono-, di-, and tri-nonylated diphenylamine, 3,5-di-t-butyl-4-hydroxy-
4 hydrocinnamic acid C₇-C₉ branched alkyl ester, and butylated (30%) octylated (24%)
5 diphenylamine.

1 5. The combination of claim 4 wherein the antioxidant is butylated (30%) octylated
2 (24%) diphenylamine.

1 6. The combination of claim 1 wherein the antioxidant is a hindered phenolic antioxidant.

1 7. The combination of claim 6 wherein the antioxidant is selected from the group
2 consisting of alkylated monophenols, alkylated hydroquinones, hydroxylated thiodiphenyl
3 ethers, alkylidenebis phenols, benzyl compounds, acylaminophenols, and esters and amides of
4 hindered phenol-substituted alkanolic acids.

1 8. The combination of claim 6 wherein the antioxidant is selected from the group
2 consisting of thiodiethylene-bis(3,5-di-t-butyl-4-hydroxyhydrocinnamate and 2,6-di-t-butyl
3 hydroxytoluene.

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1 9. The combination of claim 1 wherein the biocide is selected from the group consisting
2 of triazines, phenols, morpholines, formaldehyde releasers, azoniatricyclodecanes, omadines,
3 and oxazolidines.

1 10. The combination of claim 9 wherein the biocide is selected from the group consisting
2 of tris(hydroxymethyl)nitromethane, 1,3,5-tris(2-hydroxyethyl)-S-triazine, hexahydro-1,3,5-
3 tris(2-hydroxyethyl)-S-triazine, hexahydro-1,3,5-triethyl-S-triazine, hexahydro-1,3,5-tris(2-
4 hydroxyethyl)-S-triazine iodine complex, and 1-(3-chloroallyl)-3,5,7-triaza-1-
5 azoniaadamantane chloride).

1 11. The combination of claim 10 wherein the biocide is 1,3,5-tris(hydroxyethyl)-s-triazine.

1 12. A method for reducing the oxidative and biological degradation of a metalworking
2 fluid comprising adding thereto at least one antioxidant and at least one biocide.

1 13. The method of claim 12 wherein the antioxidant is selected from the group consisting
2 of alkylated diphenyl amines and N-alkylated phenylenediamines.

1 14. The method of claim 13 wherein the antioxidant is selected from the group consisting
2 of diphenylamine, dialkylated diphenylamine, trialkylated diphenylamine, or mixtures thereof,
3 3-hydroxydiphenylamine, 4-hydroxydiphenylamine, N-phenyl-1,2-phenylenediamine, N-
4 phenyl-1,4-phenylenediamine, mono- and/or di-butyldiphenylamine, mono- and/or di-
5 octyldiphenylamine, mono- and/or di-nonyldiphenylamine, phenyl- α -naphthylamine, phenyl- β -

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naphthylamine, di-heptyldiphenylamine, mono- and/or di-(α -methylstyryl)diphenylamine, mono- and/or di-styryldiphenylamine, N,N'-diisopropyl-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1-methylheptyl)-p-phenylenediamine, N,N'-diphenyl-p-phenylenediamine, N,N'-di-(naphthyl-2)-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine, N-(1-methylpentyl)-N'-phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, 4-(p-toluenesulfonamido)diphenylamine, 4-isopropoxydiphenylamine, tert-octylated N-phenyl-1-naphthylamino, and mixtures of mono- and dialkylated t-butyl-t-octyldiphenylamines.

15. The method of claim 12 wherein the antioxidant is selected from the group consisting of butylated (45%) octylated (19%) diphenylamine, octylated phenyl- α -naphthylamine, mono-, di-, and tri-nonylated diphenylamine, 3,5-di-t-butyl-4-hydroxy-hydrocinnamic acid C₇-C₉ branched alkyl ester, and butylated (30%) octylated (24%) diphenylamine.

16. The method of claim 15 wherein the antioxidant is butylated (30%) octylated (24%) diphenylamine.

17. The method of claim 12 wherein the antioxidant is a hindered phenolic antioxidant.

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1 18. The method of claim 17 wherein the antioxidant is selected from the group consisting
2 of alkylated monophenols, alkylated hydroquinones, hydroxylated thiodiphenyl ethers,
3 alkylidenebis phenols, benzyl compounds, acylaminophenols, and esters and amides of
4 hindered phenol-substituted alkanolic acids.

1 19. The method of claim 17 wherein the antioxidant is selected from the group consisting
2 of thiodiethylene-bis(3,5-di-t-butyl-4-hydroxyhydrocinnamate and 2,6-di-t-butyl
3 hydroxytoluene.

1 20. The method of claim 12 wherein the biocide is selected from the group consisting of
2 triazines, phenols, morpholines, formaldehyde releasers, azoniatricyclodecanes, omadines, and
3 oxazolidines.

1 21. The method of claim 20 wherein the biocide is selected from the group consisting of
2 tris(hydroxymethyl)nitromethane, 1,3,5-tris(2-hydroxyethyl)-S-triazine, hexahydro-1,3,5-
3 tris(2-hydroxyethyl)-S-triazine, hexahydro-1,3,5-triethyl-S-triazine, hexahydro-1,3,5-tris(2-
4 hydroxyethyl)-S-triazine iodine complex, and 1-(3-chloroallyl)-3,5,7-triaza-1-
5 azoniaadamantane chloride).

1 22. The method of claim 21 wherein the biocide is 1,3,5-tris(hydroxyethyl)-s-triazine.